

THE FIG CYST NEMATODE, HETERODERA FICI

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Heterodera fici Kirjanova, 1954, the fig cyst nematode, was described from rubber plant (Ficus elastica Roxb.) roots collected in the People's Republic of China (5). Since its description it has been reported in the majority of the countries where edible and ornamental figs are grown (6). In the United States, H. fici has been found in California, Florida, Louisiana, and Virginia (6,8); it is most widespread in California (9). In Florida this species has been reported only once, in 1956, on rubber plants from a commercial nursery in Winter Park.

Diagnostic characters: H. fici belongs to the "Heterodera schachtii group" because it has lemon shaped cysts (Fig. 1) with a vulval cone possessing two

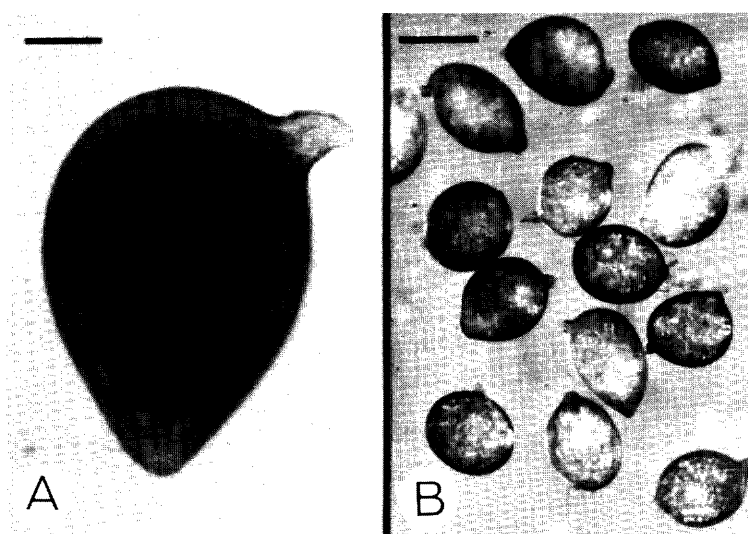


Fig. 1. Photomicrographs of Heterodera fici cysts. A) A single and B) multiple cysts. Scale bars = A) 105 μ m, B) 350 μ m.

apertures (semifenestrae) (Fig. 2B); round, brown cuticular bodies (bullae) around and beneath the edges of these apertures (Fig. 2C); and vulval aperture $> 30 \mu$ m long (Fig. 2A). Second-stage juveniles (J2) of H. fici have stylets 23-26 μ m long (Fig. 3A), and lateral fields marked by four lines (Fig. 3B) (6). H. fici is closely related to H. glycines Ichinoe, 1952, and H. schachtii Schmidt, 1871, that are present in Florida. H. fici differs from the other two species by the smaller bullae (Fig. 2C), and presence of four small nipples on the male tail (Fig. 4), which are absent in H. glycines and H. schachtii (4). H. fici males are shorter compared to H. glycines and H. schachtii males (760-1002, 1035-1400, and 1119-1438 μ m, respectively). H. fici cysts have longer semifenestrae (Fig. 2B) than those of H. schachtii (45-68 vs. 18-30 μ m). H. fici is easily differentiated from H. leuceilyma Di Eduardo and Perry, 1964, by the presence of four lateral fields on the second stage juvenile (J2) instead of three (6).

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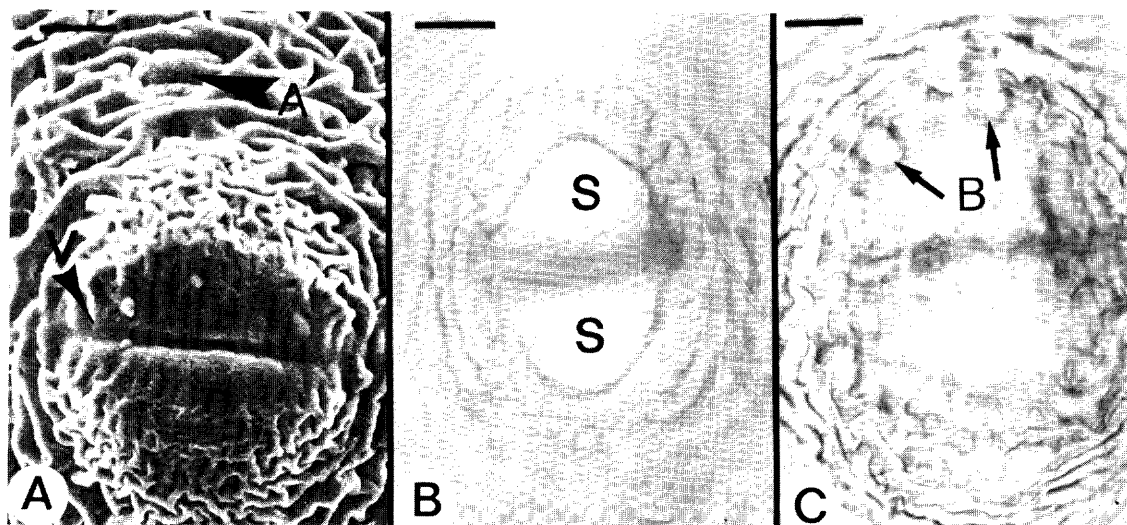


Fig. 2. Photomicrographs of vulval cones of *Heterodera fici* cysts. A) Vulval cone showing anus (A), vulva (V) and cuticular ornamentations (scanning electron microscopy). B) Vulval cone showing the semifenestrae (S). C) Vulval cone showing the bullae (B). Scale bars = A) 20 μ m, B) 18 μ m, C) 10 μ m.

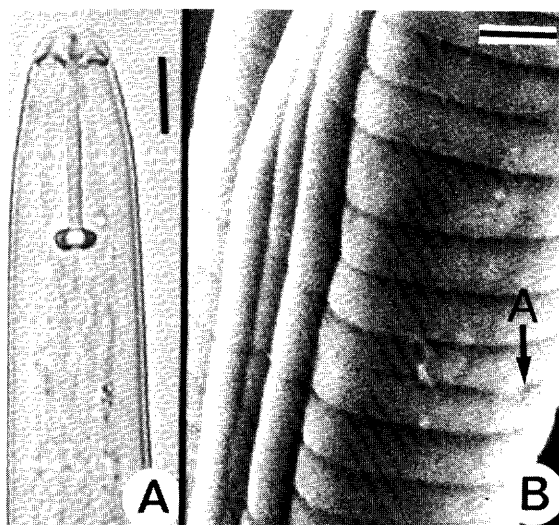


Fig. 3. Photomicrographs of *Heterodera fici*. A) Second-stage juvenile anterior body portion and B) lateral field marked by 4 lines, A = anus (scanning electron microscopy). Scale bars = A) 8.1 μ m, B) 2.1 μ m.



Fig. 4. Posterior body portion of *Heterodera fici* male. Note the characteristic nipples (N) at tail terminus. Scale bar = 8 μ m.

Host range: The host range of *H. fici* is restricted to species of the genus *Ficus*. Both edible and ornamental fig species are subject to infection by this nematode (1,9). Infestations of *H. fici* have been reported in edible fig (*Ficus carica* L.) orchards of the Mediterranean region and in Pakistan (2,4,7). *H. fici* was found infecting ornamental figs including *F. benghalensis* L., *F. elastica*, *F. lyrata* Warb., and *F. rubiginosa* Desf. in ornamental nurseries of Europe and North America (1,6,9).

Biology: *H. fici* is a sedentary endoparasite. After emerging from the egg, J2 penetrate fig feeder roots, become sedentary, swell, and establish a permanent feeding site in the stele (Fig. 5). Adult females are swollen and protrude with the posterior portion of their body from the root surface (Fig. 6A). They produce egg sacs and later become cysts (Figs. 1,2), each containing 200-250 embryonated

eggs (Fig. 6B). Males are sedentary in the juvenile stages and become active after reaching maturity.

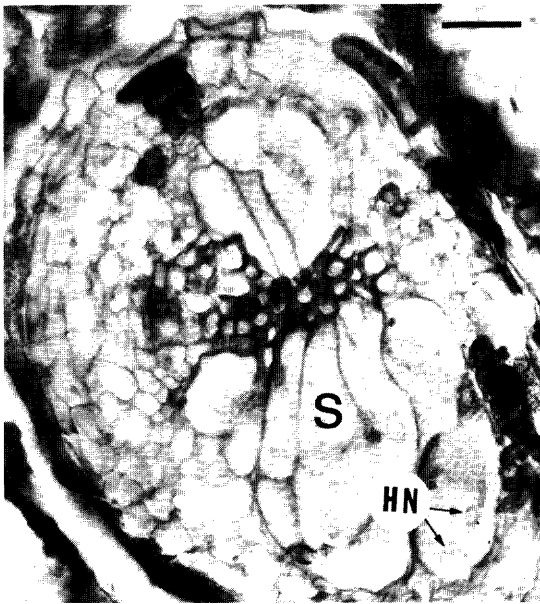


Fig. 5. Cross section of a *F. carica* root with a large syncytium (S) induced by *H. fici*. HN = hypertrophied nuclei. Scale bar = 35 μ m.

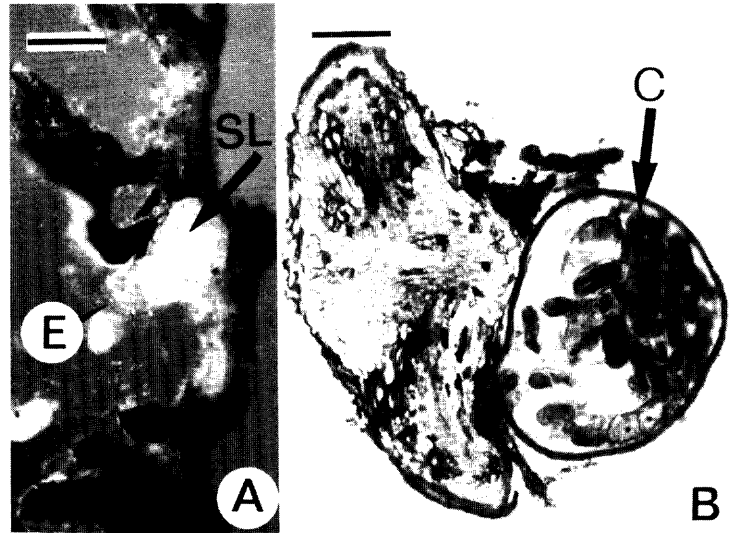


Fig. 6. *Ficus carica* roots infected with *Heterodera fici*. A) Female body posterior portion protruding from the root surface. Note the subcrystalline layer (SL) covering the nematode body and the egg sac (E). B) Cross section of a *F. carica* root with a *H. fici* cyst attached. Note eggs inside the cysts. Scale bars = A) 350 μ m, B) 115 μ m.

The nematode life-cycle, from cyst to cyst on *F. carica* seedlings, was completed in two months. Egg hatch occurred only in the presence of fig root leachates and at temperatures above 10 C, with maximum hatch at 20-25 C. Under field conditions in the Mediterranean region, this nematode may have more than one generation per year (2).

Symptoms and damage: Poor plant growth and leaf chlorosis have been reported on both edible and ornamental figs infected with *H. fici* (1,3,4) (Fig. 7). Damage to fig is greater on small seedlings than to older plants (1,3).

Anatomical alterations: Infective stages of *H. fici* cause the formation of specialized cells in the root tissues of infected hosts. These syncytial cells produce nutrients for the nematode and disrupt the stelar structure of roots (Fig. 5).



Fig. 7. Effect of *H. fici* increasing densities on the growth of *F. carica* seedlings. Numbers at bottom of pots indicate initial egg densities/cm³ of soil. Scale bar = 5.3 cm.

Control: Good sanitation practices and elimination of any source of nematode contamination are recommended for the production of healthy seedlings in commercial edible and ornamental fig nurseries. Because of the low commercial value of edible fig crops in the Mediterranean area, no chemical control treatments have been adopted in fig orchards. Biological control agents, such as a bacterium (Pasteuria sp.) and nematophagous fungi have been found infecting nematode J2 and cysts in Mediterranean fig orchards.

Detection: The Bureau of Nematology records of thousands of soil and root samples taken from Ficus species in Florida reveal only one positive recovery of H. fici. However, the earliest records (1920's and 1930's) report H. schachtii associated with several Ficus species. This was prior to the 1954 description of H. fici. It is likely that nematodes were misidentified in these reports. Ficus spp. are not presently known as hosts of H. schachtii.

Specialists should be aware of the possibility that H. fici may occur in Ficus plantings around the state. If any unusual symptoms such as poor plant growth and leaf chlorosis are observed, particularly on small seedlings, samples should be submitted to the Bureau of Nematology for examination.

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